

IN THE CLAIMS:

The text of all pending claims, (including withdrawn claims) is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~strikethrough~~. When strikethrough cannot easily be perceived, or when five or fewer characters are deleted, ~~[[double brackets]]~~ are used to show the deletion. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered). Please AMEND claims 1, 15, 24, 27, 28, and 32, and CANCEL claim 7 without prejudice or disclaimer in accordance with the following:

1. (currently amended) A positive active material composition for a positive electrode of a lithium-sulfur battery comprising:
 - a positive active material comprising a sulfur-based compound;
 - a conductive agent;
 - an organic mixing solvent comprising isopropyl alcohol ~~in which solubility of sulfur is equal to or less than 50 mM, wherein the organic mixing solvent is selected from the group consisting of dimethylformamide, isopropyl alcohol and acetonitrile, but not including tetrahydrofuran, propylene carbonate or ethylene carbonate; and~~
 - a binder comprising polyvinyl pyrrolidone, ~~at least one polymer which is~~ dissolvable in the organic mixing solvent that comprises isopropyl alcohol, ~~wherein the polymers are selected from the group consisting of polyvinylidene fluoride, polyvinyl acetate and polyvinyl pyrrolidone and, wherein~~ an amount of the binder is at least five percent by weight with respect to the positive active material composition.

2. (cancelled)

3. (cancelled)

4. (original) The positive active material composition of claim 1, wherein the binder further comprises at least oxide polymer selected from the group consisting of polyethylene oxide and polypropylene oxide.

5. (previously presented) The positive active material composition of claim 1, wherein:

the at least one polymer selected is at least one first polymer selected from the group consisting of polyvinylidene fluoride, polyvinyl acetate and polyvinyl pyrrolidone;

the organic mixing solvent is a first organic mixing solvent which dissolves the first polymer and is selected from the group consisting of dimethylformamide, isopropyl alcohol and acetonitrile;

the positive active material composition further comprises:

at least one oxide polymer selected from the group consisting of polyethylene oxide and polypropylene oxide; and

a second organic mixing solvent which dissolves the oxide polymer and is selected from the group consisting of 1,3-dioxolane and acetonitrile.

6. (original) The positive active material composition of claim 1, wherein the binder is polyvinylidene fluoride, and the organic mixing solvent is dimethyl formamide.

7. (cancelled)

8. (original) The positive active material composition of claim 1, wherein the binder is polyvinylacetate and the organic mixing solvent is acetonitrile.

9. (previously presented) The positive active material composition of claim 1, wherein the sulfur-based compound is at least one compound selected from the group consisting of elemental (S_8), solid Li_2S_n ($n \geq 1$), an organic-sulfur compound and a carbon sulfur polymer $(C_2S_x)_n$, where $x=2.5$ to 50 , and n is an integer ≥ 2 .

10. (original) The positive active material composition of claim 1, wherein the positive active material composition comprises 5 to 30 percent by weight of the binder.

11. (original) The positive active material composition of claim 1, wherein the organic mixing solvent has a solubility of sulfur of 1 to 50 mM.

12. (cancelled)

13. (original) The positive active material composition of claim 5, wherein a mixing ratio between the binder and the at least one oxide polymer is 1 to 9:9 to 1 in weight ratio.

14. (original) The positive active material composition of claim 1, wherein the conductive agent is a at least one conductive carbon material selected from the group consisting of graphite, carbon black, polyaniline, polythiophene, and polypyrrol.

15. (currently amended) A lithium-sulfur battery comprising:

a positive active material including a sulfur-based compound, a binder and a conductive agent, the binder comprising polyvinyl pyrrolidone ~~at least one polymer which dissolved in an organic mixing solvent, the organic mixing solvent having a solubility of sulfur of equal to or less than 50 mM, wherein the organic mixing solvent is selected from the group consisting of dimethylformamide, comprises isopropyl alcohol, and acetonitrile, but not including tetrahydrofuran, propylene carbonate or ethylene carbonate, and the polymers are selected from the group consisting of polyvinylidene fluoride, polyvinyl acetate and polyvinyl pyrrolidone and wherein~~ an amount of the binder is at least five percent by weight with respect to the positive active material composition;

a negative electrode comprising a negative active material, the negative active material being selected from the group consisting of materials in which lithium intercalation reversibly occurs, materials which react with lithium to form a lithium compound, a lithium metal and a lithium alloy; and

an electrolyte comprising a lithium salt and an electrolyte-organic solvent.

16. (cancelled)

17. (original) The lithium-sulfur battery of claim 15, wherein the binder further comprises at least oxide polymer selected from the group consisting of polyethylene oxide and polypropylene oxide.

18. (previously presented) The lithium-sulfur battery of claim 15, wherein the sulfur compound is at least one compound selected from the group consisting of elemental (S_8), solid Li_2S_n ($n \geq 1$), an organosulfur compound and a carbon sulfur polymer $(C_2S_x)_n$, where $x=2.5$ to 50, and n is an integer ≥ 2 .

19. (original) The lithium-sulfur of claim 15, wherein the electrolyte-organic solvent is selected from the group consisting of benzene, fluorobenzene, toluene, trifluorotoluene, xylene, cyclohexane, tetrahydrofuran, 2-methyl tetrahydrofuran, cyclohexanone, ethanol, isopropyl alcohol, dimethyl carbonate, ethylmethyl carbonate, diethyl carbonate, methylpropyl carbonate, methyl propionate, ethyl propionate, methyl acetate, ethyl acetate, propyl acetate, dimethoxy ethane, 1,3-dioxolane, diglyme, tetraglyme, ethylene carbonate, propylene carbonate, γ -butyrolactone and sulfolane.

20. (original) The lithium-sulfur battery of claim 15, wherein the lithium salt is at least one compound selected from the group consisting of lithium hexafluorophosphate ($LiPF_6$), lithium tetrafluoroborate ($LiBF_4$), lithium hexafluoroarsenate ($LiAsF_6$), lithium perchlorate ($LiClO_4$), lithium trifluoromethanesulfonate (CF_3SO_3Li) and lithium bis(trifluoromethyl) sulfoneimide($LiN(SO_2CF_3)_2$).

21. (previously presented) The lithium-sulfur battery of claim 15, wherein the electrolyte comprises a concentration of 0.5 to 2.0 M of the lithium salt.

22. (previously presented) The lithium-sulfur battery of claim 11, wherein the organic mixing solvent has a solubility of sulfur of 1 to 50 mM.

23. (cancelled)

24. (currently amended) A positive active material composition for a positive electrode of a lithium-sulfur battery comprising:
a positive active material comprising a sulfur-based compound;
a conductive agent;

an organic mixing solvent comprising isopropyl alcohol ~~being selected from the group consisting of dimethyl formamide, isopropyl alcohol and acetonitrile, but not including tetrahydrofuran, propylene carbonate or ethylene carbonate;~~ and

a binder comprising polyvinyl pyrrolidone, ~~at least one polymer being selected from the group consisting of polyvinylidene fluoride, polyvinyl acetate and polyvinyl pyrrolidone,~~ wherein an amount of the binder is at least five percent by weight with respect to the positive active material composition.

25. (original) The positive active material composition of claim 24, wherein the binder further comprises at least oxide polymer selected from the group consisting of polyethylene oxide and polypropylene oxide, and the organic solvent further comprises 1,3-dioxolane.

26. (original) The positive active material composition of claim 24, wherein the positive active material composition comprises 5 to 30 percent by weight of the binder.

27. (currently amended) A positive active material composition for a positive electrode of a lithium-sulfur battery comprising:

a positive active material comprising a sulfur-based compound;

a conductive agent;

an organic mixing solvent comprising isopropyl alcohol, ~~wherein the organic mixing solvent is selected from the group consisting of dimethylformamide, isopropyl alcohol and acetonitrile, but not including tetrahydrofuran, propylene carbonate or ethylene carbonate;~~ and

a binder comprising polyvinyl pyrrolidone, ~~at least one polymer which become ionic conductive when wetted by a liquid or gel electrolyte, and wherein the polymers are selected from the group consisting of polyvinylidene fluoride, polyvinyl acetate and polyvinyl pyrrolidone and~~ wherein an amount of the binder is at least five percent by weight with respect to the positive active material composition.

28. (currently amended) A method of preparing a positive electrode for a lithium-sulfur battery comprising:

dissolving a binder comprising ~~at least one polymer~~ polyvinyl pyrrolidone in an organic mixing solvent ~~in which solubility of sulfur is equal to or less than 50 mM~~ comprising isopropyl alcohol, to obtain a first mixture, ~~wherein the organic mixing solvent is selected from the group consisting of dimethylformamide, isopropyl alcohol and acetonitrile, but not including tetrahydrofuran, propylene carbonate or ethylene carbonate~~ and an amount of the binder is at least five percent by weight with respect to a positive active material comprising a sulfur-based compound;

dispersing a conductive agent into the first mixture to obtain a dispersion solution;

homogeneously dispersing the positive active material in the dispersion solution, to prepare a positive electrode composition; and

coating the positive electrode composition to a current collector and drying the coated current collector.

29. (cancelled)

30. (original) The method of claim 28, wherein the organic mixing solvent is selected from the group consisting of dimethylformamide, isopropyl alcohol and acetonitrile.

31. (original) The method of claim 28, wherein the binder further comprises at least oxide polymer selected from the group consisting of polyethylene oxide and polypropylene oxide.

32. (currently amended) A method of preparing a positive electrode for a lithium-sulfur battery comprising:

dissolving a binder comprising ~~at least one polymer selected from the group consisting of polyvinylidene fluoride, polyvinyl acetate and polyvinyl pyrrolidone~~ in an organic mixing solvent ~~selected from the group consisting of dimethyl formamide, isopropyl alcohol and acetonitrile, but not including tetrahydrofuran, propylene carbonate or ethylene carbonate~~ comprising isopropyl alcohol to obtain a first mixture and wherein an amount of the binder is at least five percent by weight with respect to the positive active material composition;

dispersing a conductive agent into the first mixture to obtain a dispersion solution;

homogeneously dispersing a positive active material comprising a sulfur-based compound in the dispersion solution, to prepare a positive electrode composition; and

coating the positive electrode composition to a current collector and drying the coated current collector.

33. (cancelled)

34. (original) The method of claim 32, wherein the organic mixing solvent is selected from the group consisting of dimethylformamide, isopropyl alcohol and acetonitrile.

35. (original) The method of claim 32, wherein the binder further comprises at least oxide polymer selected from the group consisting of polyethylene oxide and polypropylene oxide.